

5        **CLAIMS**

The claims are as follows:

1.        A method of determining mercury levels in a biological sample containing mercury comprising the steps of:

10        (a)        at least partially dissolving said biological sample containing mercury in an acidic solution to release at least a portion of the mercury contained therein into said acidic solution;

          (b)        exposing said acidic solution to a first anode and a cathode connected by an electromotive force to adhere at least a portion of the mercury released from said biological sample to a surface of said cathode;

15        (c)        providing a second anode and exposing said surface of said cathode and adhered mercury to a solution of an alkaline metal salt under the influence of an electromotive force established between said second anode and cathode to create an alkaline metal amalgam on the surface of said cathode;

          (d)        connecting said cathode to a reference electrode; and

20        (e)        measuring any voltage difference between said cathode and reference electrode as a measure of the mercury level in the biological sample.

2.        The method of claim 1 wherein said biological sample containing mercury comprises fish.

25        3.        The method of claim 1 wherein said cathode comprises a member selected from the group consisting of aluminum, platinum, gold, silver, zinc and copper.

4.        The method of claim 1 wherein said cathode comprises aluminum.

5.        The method of claim 1 wherein said first and second anodes each comprise carbon or platinum.

30        6.        The method of claim 1 wherein said reference electrode comprises a member selected from the group consisting of carbon, platinum, gold, silver and aluminum.

7.        The method of claim 1 wherein an oxidizing agent is provided during the step of at least partially dissolving said biological sample containing mercury in said acidic solution.

5           8.       The method of claim 7 wherein said oxidizing agent comprises potassium chlorate.

          9.       The method of claim 1 wherein said acid solution comprises an acid selected from the group consisting of hydrochloric acid, nitric acid, and sulfuric acid.

10          10.      The method of claim 1 wherein said alkaline metal salt comprises a member selected from the group consisting of a salt of sodium, potassium, lithium, rubidium and cesium.

          11.      The method of claim 10 wherein said alkaline metal salt comprises a buffered solution of sodium chloride.

15          12.      The method of claim 1 wherein said biological sample containing mercury comprises fish dissolved in a 12M hydrochloric acid solution in the presence of potassium chlorate as an oxidizer.

          13.      The method of claim 1 wherein said electromotive force of step (b) comprises a voltage between approximately 1.5 to 6 volts at a current of approximately 5 to 150 mA.

20          14.      The method of claim 1 wherein said electromotive force of step (c) comprises a voltage between approximately 7 to 15 volts, at a current of approximately 50 to 200 mA.

          15.      The method of claim 1 wherein said electromotive force comprises a regulated power supply.

25          16.      The method of claim 15 wherein said regulated power supply comprises a constant current power supply.

          17.      The method of claim 1 wherein said biological sample containing mercury is subjected to stirring or agitation while being dissolved in said acidic solution.

30          18.      A method of determining mercury levels in a biological sample containing mercury comprising the steps of:

          (a)      at least partially dissolving said biological sample containing mercury in an acidic solution containing an alkaline metal salt to release at least a portion of the mercury contained therein into said acidic solution;

5           (b)     exposing said acidic solution to an anode and a cathode connected by an electromotive force to adhere at least a portion of the mercury released from said biological sample to a surface of said cathode forming a mercury-alkaline metal amalgam;

          (c)     connecting said cathode to a reference electrode; and

10          (d)     measuring any voltage difference between said cathode and reference electrode as a measure of the mercury level in the biological sample.

          19.     A device for determining mercury levels in a biological sample containing mercury, comprising a first chamber including a port for the introduction of a measured quantity of said biological sample, said first chamber including a measured quantity of an  
15     acidic solution of sufficient molarity and quantity to release at least a portion of mercury contained therein and into said acidic solution, a cathode and a first anode positioned at least partially within said acidic solution and selectively connected through an electromotive force, a solution of an alkaline metal salt and a second anode that is selectively electrically connected to said cathode through an electromotive force when  
20     said cathode is in the presence of said alkaline metal salt solution, and a reference electrode selectively electrically connected to said cathode through an indicating device.

          20.     The device of claim 19 wherein said source of alkaline metal salt solution is contained within a second chamber.

          21.     The device of claim 20 wherein said second chamber also contains said  
25     second anode and said reference electrode.

          22.     The device of claim 21 wherein said cathode is movable between said first and second chambers.

          23.     The device of claim 22 wherein said first and second chambers are joined through the use of an at least partially sealable membrane.

30          24.     The device of claim 19 wherein said biological sample containing mercury comprises fish.

          25.     The device of claim 19 wherein said cathode comprises a member selected from the group consisting of aluminum, platinum, gold, silver, zinc and copper.

          26.     The device of claim 19 wherein said cathode comprises aluminum.

5           27.     The device of claim 19 wherein each of said first and second anodes  
comprise carbon or platinum.

          28.     The device of claim 19 wherein said reference electrode comprises a  
member selected from the group consisting of carbon, platinum, gold, silver and  
aluminum.

10          29.     The device of claim 19 wherein an oxidizing agent is provided within said  
first chamber together with said measured quantity of said acidic solution.

          30.     The device of claim 29 wherein said oxidizing agent comprises potassium  
chlorate.

          31.     The device of claim 19 wherein said acidic solution comprises an acid  
15 selected from the group consisting of hydrochloric acid, nitric acid and sulfuric acid.

          32.     The device of claim 19 wherein said alkaline metal salt comprises a  
member selected from the group consisting of a salt of sodium, potassium, lithium,  
rubidium and cesium.

          33.     The device of claim 32 wherein said alkaline metal salt comprises a  
20 buffered solution of sodium chloride.

          34.     The device of claim 19 wherein said biological sample containing mercury  
comprises fish and said measured quantity of acidic solution comprises a 12M  
hydrochloric acid solution further containing potassium chlorate as an oxidizer.

          35.     The device of claim 19 wherein said electromotive force between said  
25 cathode and first anode comprises a voltage between approximately 1.5 to 6 volts at a  
current of approximately 5 to 150 mA.

          36.     The device of claim 19 wherein said electromotive force between said  
cathode and second anode comprises a voltage between approximately 7 to 15 volts at a  
current of approximately 50 to 200 mA.

30          37.     The device of claim 19 wherein said indicating device comprises a meter.

          38.     The device of claim 19 wherein said electromotive force comprises a  
regulated power supply.

          39.     The device of claim 19 wherein said regulated power supply comprises a  
constant current power supply.

5           40.     The device of claim 19 wherein means are provided for stirring or  
agitating said biological sample containing mercury while said mercury contained therein  
is being released into said acidic solution.

          41.     A device for determining mercury levels in a biological sample containing  
mercury, comprising a first chamber including a port for the introduction of a measured  
10   quantity of said biological sample, said first chamber including a quantity of an acidic  
solution of sufficient molarity and quantity to release at least a portion of mercury  
contained therein and into said acidic solution, a cathode, an anode positioned at least  
partially within said acidic solution and selectively connected through an electromotive  
force and a solution of an alkaline metal salt and a second chamber containing a reference  
15   electrode selectively electrically connected to said cathode through an indicating device.

          42.     A kit for determining mercury levels in a biological sample containing  
mercury comprising a first chamber including a port for the introduction of a measured  
quantity of said biological sample and a measured quantity of an acidic solution of  
sufficient molarity and quantity to release at least a portion of mercury contained in said  
20   biological sample, a second chamber containing a solution of alkaline metal salt, a  
cathode and first anode positionable within said first chamber and a second anode and  
reference electrode positioned within said second chamber.

          43.     The kit of claim 42 wherein said cathode is movable between said first and  
second chambers.

25           44.     The kit of claim 42 wherein said first and second chambers are joined  
through an at least partially sealable membrane.

          45.     The kit of claim 42 wherein said cathode comprises a member selected  
from the group consisting of platinum, gold, silver, zinc, copper and aluminum.

          46.     The kit of claim 42 wherein said first and second anodes comprise carbon  
30   or platinum.

          47.     The kit of claim 42 wherein said first chamber further includes an  
oxidizing agent.

          48.     The kit of claim 47 wherein said oxidizing agent comprises potassium  
chlorate.

5           49.     The kit of claim 42 wherein said acid solution comprises an acid selected from the group consisting of hydrochloric acid, nitric acid and sulfuric acid.

          50.     The kit of claim 42 wherein said alkaline metal salt contained within said second chamber comprises a buffered solution of sodium chloride.

10          51.     The kit of claim 42 wherein said first chamber further contains mercury ions

          52.     A kit for determining mercury levels in a biological sample containing mercury comprising a first chamber including a port for the introduction of a measured quantity of said biological sample, a measured quantity of an acidic solution of sufficient molarity and quantity to release at least a portion of mercury contained in said biological  
15   sample and a solution of alkaline metal salt, a cathode and anode positionable within said first chamber and a second chamber containing a reference electrode.